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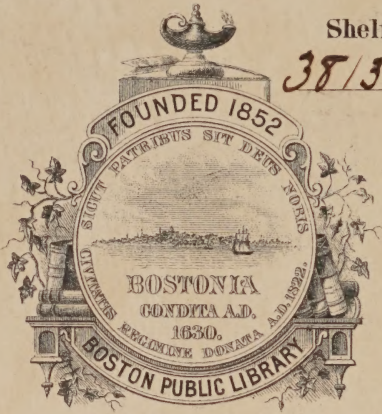


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REPORT OF THE COMMITTEE
OF THE
American Society of Naturalists,
ON
SCIENCE TEACHING IN THE
SCHOOLS.

ADOPTED AT THE ANNUAL MEETING OF THE SOCIETY,
PHILADELPHIA, DECEMBER, 1891.

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REPORT OF THE COMMITTEE

ON

SCIENCE TEACHING IN THE SCHOOLS.

THE Committee are glad to be able to report progress in several directions.

At the meeting of the Ohio College Association, December, 1890, the following resolution was unanimously adopted:—

“This Association is of the opinion that the Natural Sciences should be taught demonstratively, as far as possible, in all grades of the Common Schools; and that, so soon as feasible, some branch of science should be included in the requirements for admission to College.”

Since our last annual meeting, a circular letter has been sent out to the American Universities and Colleges, in number nearly four hundred. The circular reads as follows:—

“*To the Faculty of.....*”

“In behalf of the American Society of Naturalists, we respectfully petition your honorable body to take into consideration the question of making such a change in your requirements for admission as to include therein some work in Natural or Physical Science.

“In presenting this petition, it is appropriate for us to give briefly the reasons which have led the Society to this action.

“The Society of Naturalists is a body of investigators and teachers of Natural Science. The majority of its members are professors of Biology or Geology in colleges or other higher institutions of the north-eastern United States. Its meetings have been mainly occupied with discussions as to the methods of carrying on the various branches of scientific work in which its members are engaged. The discussion of education in science has accordingly occupied much of its attention.

“In the consideration of scientific instruction in College, with a view to its improvement in method and result, the conclusion

has forced itself upon our minds, that the main cause of the unsatisfactory results of scientific instruction in College is to be found in the lack of suitable elementary scientific training on the part of the students.

“While a liberal allowance of time is devoted to scientific studies in most of the College courses and in the English courses in Academies and High Schools, there is generally little or no time allotted to science in the Classical courses in Academies and High Schools, and in the schools of lower grade. Most of the students in the Colleges have therefore received no training or instruction in the sciences before reaching those studies in the College course. By so many years of exclusive attention to other subjects, their powers of observation and of imagination of physical phenomena are well-nigh atrophied; and the loving interest in nature, innate in every normal child, instead of being systematically developed, is well-nigh extinguished.

“The remedy for this state of things is to be found in the introduction of elementary lessons in science at a much earlier period of the course. We believe that the study of nature should begin in the Primary School, and should continue, in increasingly systematic and philosophical methods, through all grades of the educational system. We believe that, in the light of sound principles of pedagogics, a system of education must be pronounced radically defective, which fails to gratify and to stimulate the curiosity of children in regard to the things about them and within them, confining them to more abstract studies, some of which are better suited to maturer minds.

“So far as the reform which we advocate relates to schools below the grade of the High School or Academy, we can ask from you only sympathy and moral support. But one most important step of progress is absolutely dependent upon the action of College Faculties and Corporations. The better class of High Schools and Academies are prepared to furnish instruction of very respectable quality in various departments of science; and actually do furnish such instruction to those of their students who are not preparing for College. They are ready to furnish such instruction to those students who are preparing for College, just as soon as it can find recognition in the Colleges as a part of the preparatory course.

“Hence we are led to make an earnest appeal to the Faculties

of the Colleges to make some work in science form a part of the requirements for admission, being assured that in so doing they will be taking a most important step in the direction of a symmetrical and philosophical arrangement of the educational course.

“The question of the particular sciences which should be required for admission is a comparatively unimportant one. In the report adopted at the meeting of the Society in 1888 (a copy of which is forwarded herewith), the Committee recommended the selection of *Phænogamic Botany*, *Human Physiology*, and *Physical Geography*; the first, as furnishing most conveniently a thorough observational discipline; the second, as affording information of great utility; the third, as tending to keep alive a general sympathy with nature. It was, moreover, believed that the High Schools and Academies in general are prepared to teach these at least as well as any other science studies. There is, however, room for difference of opinion on the question whether other sciences, as *Physics*, *Chemistry*, and *Zoölogy*, may not have equal or even superior claims; and it is not unlikely that some preparatory schools are able to afford better instruction in some other sciences than in those recommended in the report. It would probably be best for the present, especially in view of the great inequality in the resources of different preparatory schools, to allow some degree of option to the candidate in regard to the particular science or sciences in which he should be examined. The point which we consider essential is that some study of nature should be required before admission to College.

“If it is deemed impracticable to make the proposed change in the requirements immediately, we would earnestly request that the principle be recognized by the insertion in the next Catalogue of a notice that some work in Natural Science will be required for admission after the year 1892 (or some other date that may seem convenient).

“We send you herewith the reports of the Committee on Science Teaching in the Schools, which have been unanimously adopted at the last two annual meetings of the Society, and an address of the President at the last annual meeting bearing upon the same subject. These documents will serve to set forth somewhat more fully the views of the Society, and will also give some history of the efforts which the Committee has made to call attention to these

views, and of the favor with which they have been regarded by prominent Educational Associations.

“In addition to the endorsements of our views on the part of prominent Educational Associations, quoted in our second report, we would call attention to the following resolution, unanimously adopted by the Association of Officers of Colleges in New England, at its meeting in Middletown, Connecticut, Nov. 7, 1890.

“The Association of Officers of Colleges in New England desires to support the endeavor of the American Society of Naturalists to introduce instruction in Natural Science into schools; and the Association agrees with the Society in thinking it indispensable that the methods of instruction should invariably be demonstrative.’

“SAMUEL F. CLARKE, Williams College.

“WILLIAM G. FARLOW, Harvard University.

“GEORGE L. GOODALE, Harvard University.

“GEORGE MACCLOSIE, College of New Jersey.

“WILLIAM NORTH RICE, Wesleyan University.

“HENRY FAIRFIELD OSBORN, College of New Jersey.

“WILLIAM T. SEDGWICK, Mass. Institute of Technology.

“SIDNEY I. SMITH, Yale University.

“C. O. WHITMAN, Clark University.”

Answers to this circular were not solicited; but information has come to us from several of the New England Colleges showing that the matter has received the serious consideration of the several Faculties. All of the Colleges from which we have heard are at least unwilling to say they will not make the change in a few years, and two of the Colleges have taken definite steps in this direction. They all believe that something ought to be done. One wishes to see what certain other Colleges will do; another has made sufficient changes this year, but may be willing to move in this direction another year. A third has announced in its Catalogue that hereafter an examination in Natural Science will form one of the requisites for admission to the scientific course. At still another College, the offer is made in its Catalogue to receive men into advanced standing in Science who can pass special examinations requisite for those courses.

One of the committee read a paper at the sixth annual meeting of the New England Association of Colleges and Preparatory Schools, entitled, "Natural Science as a Requisite for Admission to College." One of the facts stated in that paper is worth mentioning here. The writer was one of a committee of three which sent a circular letter to one hundred of the schools from which Williams College has received students in the last four years, asking them if they could prepare their students on the basis of a Natural Science requisite by 1893, or later. Of the ninety answers received, thirty-two are from Massachusetts, twenty-six are from New York, and the others are from all the other New England States, New York, New Jersey, Pennsylvania, Ohio, Illinois, and Minnesota. It is a remarkable and significant fact that every school replied that they could so prepare their pupils. Again, of the ninety, nine answer, "yes," but object to the plan; the main objection being lack of time in the already busy course. Forty-five answer simply, "yes," and thirty-six add some word of decided approval.

In the discussion following this paper, President G. Stanley Hall offered the following suggestion: "There is a great difference between subjects which have had for years the benefit of a good pedagogic manipulation and those which have not. Pedagogic thought has not been given to Science study. Text-books in Science have not had the benefit of pedagogic experience. Results might be attained if we were to appoint, for instance, a committee to arrange a conspectus of the work in Science."

Thereupon it was moved and voted by the New England Association of Colleges and Preparatory Schools:

"That the Executive Committee be instructed to consider the expediency of appointing a committee to formulate suggestions relating to Elementary Science as a requisite for admission to College, and have full authority to appoint such a committee if this action seems desirable."

The Executive Committee will meet next month, and the Secretary informs me that such a committee will probably be appointed.

At the recent meeting of the Association of Colleges in New

England, it was voted to send the following circular letter to the Faculties of the Colleges included in its membership:—

“ *To the Faculty of*

“ At the 35th annual meeting of the Association of Colleges in New England, held at Brown University, Nov. 5-6, 1891, it was

“ *Voted*, That the memorandum printed below be transmitted to the various Faculties for their consideration and for action by this Association next year; also *voted*, that the memorandum, with a statement of this reference of the same to the Faculties, be offered to the press for publication.

“ MEMORANDUM.

“ The Association of Colleges in New England, impressed with the real unity of interest and the need of mutual sympathy and help throughout the different grades of public education, invites the attention of the public to the following changes in the programme of New England Grammar Schools, which it recommends for gradual adoption:—

“ 1. The introduction of Elementary Natural History into the earlier years of the programme as a substantial subject, to be taught by demonstrations and practical exercises rather than from books.

“ 2. The introduction of Elementary Physics into the later years of the programme as a substantial subject, to be taught by the experimental or laboratory method, and to include exact weighing and measuring by the pupils themselves.

“ 3. The introduction of Elementary Algebra at an age not later than twelve years.

“ 4. The introduction of Elementary Plane Geometry at an age not later than thirteen years.

“ 5. The offering of opportunity to study French, or German, or Latin, or any two of these languages, from and after the age of ten years.

“ In order to make room in the programme for these new subjects, the Association recommends that the time allotted to Arithmetic, Geography, and English Grammar be reduced to whatever extent may be necessary.

“The Association makes these recommendations in the interest of the public school system as a whole; but most of them are offered more particularly in the interest of those children whose education is not to be continued beyond the Grammar School.

“JOHN HOWARD APPLETON,
“*Secretary.*”

An investigation has been made to ascertain the actual status of the Colleges and Preparatory Schools in the territory with which the Society of Naturalists is especially concerned (namely, the region of the North Atlantic States from Maine to the District of Columbia inclusive) as regards the inclusion of Science in the Preparatory Course. Circulars were sent to all the Institutions within that area catalogued, in the latest Report of the Commissioner of Education, as Colleges or Scientific Schools, and also to the Academies and High Schools catalogued in the same Report as having respectively six or more teachers, asking for catalogues or statements of courses of study. The Institutions catalogued as Colleges or as Scientific Schools vary considerably in grade; but it was deemed best to follow the classification given in the report of the Commissioner of Education, rather than to exercise a personal judgment in the case of individual Institutions. The limitation of the inquiry, in regard to Academies and High Schools, to those having a Faculty of not less than six instructors, was intended as a rough way of eliminating very small and unimportant schools. A number of the High Schools and Academies from which information was received, proved to be not Preparatory Schools for College at all, and are accordingly not counted in the following statistics. The answers received from a few schools were so vague as not to admit of tabulation. Institutions having a course of study of more than four years, of which the last four years correspond approximately to the Collegiate Course, and the previous year or years to the closing part of the Preparatory Course, are counted in the following statistics both as Colleges and as Preparatory Schools.

Of sixty-nine Colleges from which answers have been received, only eighteen now require Science for admission to the Course for the Degree of Bachelor of Arts. These are Howard University, Baltimore City College, Johns Hopkins University, Western

Maryland College, Boston University, Harvard University, Alfred University, Wells College, Polytechnic Institute of Brooklyn, College of the City of New York, Manhattan College, Syracuse University, Lebanon Valley College, Geneva College, Monongahela College, Franklin and Marshall College, Allegheny College, Swarthmore College.

Eleven other Colleges recognize the place of Science in the pre-collegiate portion of the educational course, by requiring it for admission to Scientific Courses, by allowing it as an optional subject in the examination for admission, or by announcing it as a prospective requirement. These are Wesleyan University, Smith College, Williams College, Dartmouth College, Colgate University, Lafayette College, Ursinus College, Pennsylvania College, Haverford College, Westminster College, University of Pennsylvania.

The remaining forty Colleges afford no recognition whatever of the place of Science in the pre-collegiate course of study.

Of twenty-one Institutions catalogued as Scientific Schools from which answers have been received, ten do, and eleven do not, require some Science for admission.

Of one hundred and forty-one Preparatory Schools from which answers have been received, ninety-eight include Science, either as a required or as an elective study, in the course preparatory for the Classical Courses in the Colleges. This fact seems to indicate that the Academies and High Schools are in advance of the Colleges in the recognition of the claims of Science to a place in the pre-collegiate part of the educational course. There is no doubt that nearly all Preparatory Schools of high grade would be ready to give liberal attention to scientific instruction, if their scholars could receive credit for it as meeting thereby a requirement for admission to the Colleges. /

One of the most frequent objections urged against the requirement of Science for admission to College is the alleged impossibility of finding time for the study in the four years' course of the Preparatory Schools. We believe that this objection is sufficiently refuted by the information which we have gathered in regard to the actual courses of study in the Preparatory Schools. The requirements for admission to the Classical Course in most of the Colleges consist substantially of Latin, Greek, and

Mathematics, with a little History and English Literature. In order to meet these requirements, the student is ordinarily expected to spend four years in a High School or Academy after the completion of the courses in the Primary and Grammar Schools. A length of four years for the preparatory course is necessitated by the amount of Latin required, which, with the methods of study at present in use, is amply sufficient to occupy the time of a recitation five times a week for four years. The work in Greek and in Mathematics, however, is much less than four years' work; and the slight requirements in History and English Literature do not suffice to bring the work up to the standard of about sixteen recitations per week for the four years. There remains, therefore, in a four years' course in an Academy or High School, some time which may be, and which actually is, occupied by other studies than those required for admission to College. Many Schools actually do include Science or Modern Languages in their Classical Courses, although these studies are not now required for admission to most of the Colleges. Many Schools include more extended studies in English Literature than are required for admission to College, or other advanced studies entirely outside of the College requirements. A large number of Schools occupy a considerable part of the first year with studies in the common English branches, which should be completed in the Grammar Schools. And a considerable number of the Schools devote the greater part or the whole of the last term to reviews of the studies of previous years—a time-wasting plan, whose justification, if it ever had any, has been largely removed, since many of the Colleges now accept certificates from first-class Preparatory Schools in lieu of examination, and since nearly all the Colleges allow preliminary examinations on the earlier portions of the Preparatory Course.

Among the Preparatory Schools from which sufficiently definite information has been received, there are seventy-four which appear to have substantially the normal four years' Preparatory Course. In selecting this number of schools for further consideration, we have rejected all those in which the time devoted to the Course preparatory for College (as indicated by the period of commencing Latin) is either more or less than four years; and have rejected also those few schools whose Preparatory Course is largely

elective, in adaptation to the peculiar requirements of Harvard University. Of the remaining seventy-four schools from which we have information, forty-seven include in their courses more or less of Science, thirty-two include one or both of the Modern Languages, fifty include miscellaneous advanced studies not required for admission to College, fifty-five occupy a considerable time with common English branches, and fifty occupy a considerable portion of the last year with reviews of the previous years. It is a very noteworthy fact that, of the whole number, there is not one which does not fill out its course in one or more of the five ways specified. These facts, we claim, conclusively prove that the studies now required for admission to College do not occupy the whole time of a four years' course subsequent to the completion of the Grammar School course. There is, therefore, ample time in the High School or Academy Course to meet a moderate requirement in Natural Science for admission to College.

The facts which have come to the knowledge of the Committee, and some of which are presented in this report, indicate clearly that there exists, among all ranks of educators, a conviction continually widening and continually growing more active, that a prominent place should be given to Natural Science in the earlier portions of the educational course. We believe, however, that there is danger that in many quarters this movement may fail of the good results which it should accomplish, by reason of a misapprehension in regard to the true purpose and method of scientific instruction. There is danger of getting, in many schools, the form of science teaching without the substance, — a memorizing of definitions and verbal statements of scientific facts, without bringing the minds of the pupils into inspiring and vitalizing contact with nature. However important the knowledge of scientific facts may be as matter of information, it should never be forgotten that the main benefit of scientific study lies in the discipline of the powers of perception, imagination, comparison, and reasoning, by the practice of observation and experiment upon natural objects, and by judiciously guided reflection upon the phenomena which are brought before the student's attention. Especially pernicious will it be, if the learning of verbal propositions is allowed to take the place of those object lessons

in Science which should form the main part of the scientific instruction in the Primary Schools. In the lower grades of the schools, systematized bodies of fact and doctrine are altogether out of place. While the scientific instruction in the High Schools and Academies may be and should be more systematic than in the lower schools, it should be continually remembered that the discipline gained by actual contact with nature in observation and experiment is worth far more than any amount of second-hand information.

The greatest difficulty in the way of securing the right kind of instruction arises, of course, from the lack of properly trained teachers. It is, however, a profoundly gratifying fact that this lack is gradually but surely being supplied. Within the last twenty years, a great change has taken place in the boards of instruction in High Schools and Academies. Twenty years ago the faculty of an average High School in a second-class town consisted of one College graduate, who taught Latin and Greek, and a number of young ladies, graduates only of the High School itself, who taught all the other branches. Now, thanks to the work of the women's Colleges and the co-educational Colleges, the teachers in the High Schools and Academies are coming to be almost exclusively College graduates. High School teachers who have had Laboratory training themselves in some of the Sciences, will not be content to teach those Sciences without giving some Laboratory work to their pupils. Hence it is gradually coming to pass that the graduates of High Schools, Academies, and Normal Schools, from whose ranks the teachers of the Primary and Grammar Schools are chiefly supplied, possess an acquaintance with Science which, though limited in scope, is in considerable part sound in method. The Summer Schools and Seaside Laboratories afford the opportunity for scientific instruction of the right sort to those ambitious teachers whose opportunities of early education are recognized by themselves as inadequate. Let it be clearly recognized that the teacher of Science demanded even in the Primary Schools is not one who has committed to memory some verbal propositions about Science, but one who has learned to observe and experiment, to compare and reason, — and the conditions are already in existence which will not fail to supply that demand.

The work of the Committee during the year has involved some expense in printing, postage, etc., which expense the Committee ask the Society to assume.

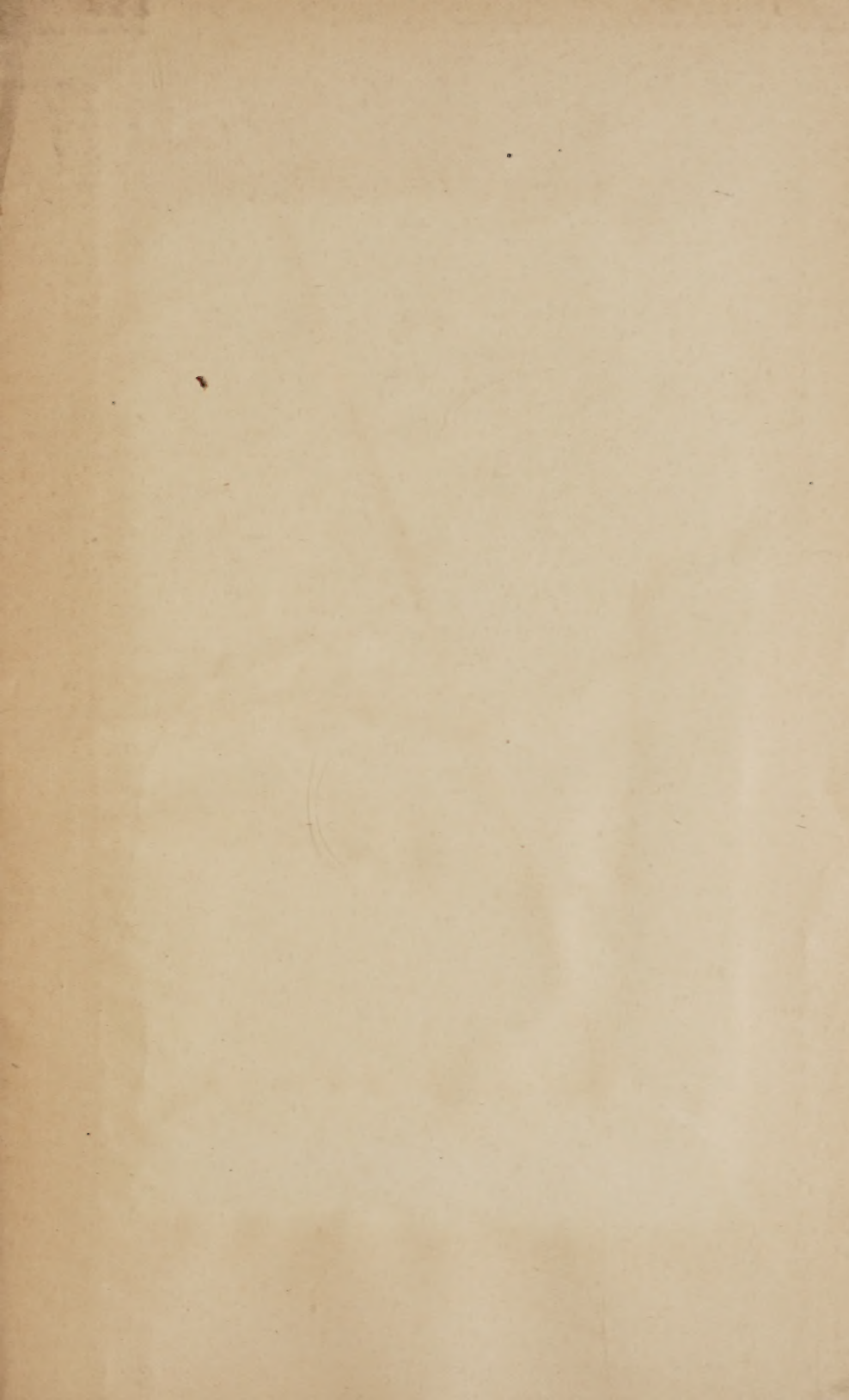
We also ask to have authorized the publication of a special edition of five hundred copies of this report for distribution in educational circles.

The above is respectfully submitted.

SAMUEL F. CLARKE,
Chairman.







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